mid, would be equal to 13·752 English inches, or 1·146 feet, and to 34·919 centimetres. The weight of water contained in such a cubit foot would be 42·578 kilogrammes, thus closely approximating to the weight of the great Alexandrian Talent in the time of the Ptolemies.

These investigations show that it is quite possible that the granite ball now found may have been an ancient Egyptian Mina weight. It has been suggested that it may have been used as a hammer, as it is known that at early periods stone balls were so used; and indeed, a part of the surface of the ball looks as if some of the granite had been knocked away. But even if so used, it by no means follows that it was not originally intended as a weight, for evidence was given before the Standard Commission by our Local Inspectors of Weights and Measures that brass standard weights not unfrequently show evident marks of having been used as hammers. If a portion of the weight had thus been knocked off, the difference between its present weight of 539·282 grammes, and the weight of the ancient Egyptian commercial Mina of 587 grammes, might be readily accounted for. Assuming the granite to have been really an Egyptian weight, it must be the most ancient weight now existing.

Some words may be added, in conclusion, upon the possibility of ascertaining the unit of ancient Egyptian weight from the internal dimensions of the coffer in the King's Chamber of the Great Pyramid, this coffer of red granite having been often considered to be a standard measure of capacity. Its internal dimensions were accurately measured by Prof. Piazzi Smyth, and were determined as follows:—

Mean length = 77·93 inches
„ breadth = 26·73 „
„ depth = 34·34 „

The capacity of the coffer is thus equal to 71·532 cubic inches, or 41·396 cubit feet, equivalent to 1171·129 cubic decimetres, showing its contents of water to weigh 1171·129 kilogrammes, equivalent to 2581·89 avoirdupois pounds; or, if the English weight of the cubic foot of water at its ordinary temperature, viz. 62·321 lbs., be taken, the contents of the water would weigh 2579·840 lbs. This result is in no way commensurable with the unit of weight derived from either of the before-mentioned ancient units of linear length, nor do the measurements of the coffer agree with any round number of such units of length. The coffer thus fails to afford an indication to the unit of ancient Egyptian weight, according to this mode of computation. H. W. C.

THE DIATHERMANCY OF FLAME

It will be seen by the following exposition that the criticism contained in the article written by W. Mattieu Williams, published in Nature, vol. vi. pp. 506, 507, is based on wrong assumptions.

The apparatus illustrated in Nature, vol. vi. p. 458, was constructed for the purpose of determining certain questions connected with the passage of solar rays through flame. Incidentally it admits of being employed for ascertaining the retardation suffered by artificial radiant heat in passing through a series of flames. The table before published contains the result of a recent preliminary experiment instituted to show that the transparency of flame is too imperfect to warrant the important inference which Père Secchi has drawn from Père Provenzali's experiment with a series of small flames.

The assumption that the experiment published in Nature was intended to settle the abstract question of diathermancy is wholly gratuitous. Probably there is no problem within the range of experimental philosophy more difficult, or requiring more time, patience, and delicate instruments for its solution, than the diathermancy of flame.

Regarding the supposed imperfections of the apparatus under consideration, the following statement will suffice:—1. Mr. Williams asserts that the main pipe to which the burners are applied is too small to afford a full supply of gas. The internal diameter of this pipe is 0·75 ins. = 0·4417 square ins. Now, it has been long established in practice that an opening of 0·0037 sq. ins. is capable of discharging six cubic feet of gas per hour, under ordinary pressure. Mr. Williams's seventeen burners consumed, agreeably to his statement, *five* cubic feet of gas per hour. The sectional area of the supply pipe, imagined to be too small, is therefore $\frac{0{\cdot}4417}{0{\cdot}0037}$ = 119 times greater than the area of an opening capable of discharging more gas in a given time than the quantity consumed by the seventeen burners employed by the author of "The Fuel of the Sun." 2. The assumption that the prolongation of the axis of the conical chamber passes through "much of the blue portion of the flame" is groundless. The distance of the gas-pipe from the conical vessel, during the experiment, was so adjusted that the prolongation of the axis of the latter passed through the flames at the point of greatest intensity. But, had this adjustment been neglected, the radiant heat, acting on the thermometer, would not have suffered any diminution, since the intensity transmitted depends solely on the extent of the ignited portion of the flame. The criticism regarding the position of the axis of the instrument has therefore no bearing on the question at issue. 3. Mr. Williams's disquisition relating to the retarding influence of the vapour contained in flames, so far from establishing the perfect diathermancy assumed by Père Secchi, proves, if we admit the soundness of the reasoning, that radiant heat does not pass freely through flames when arranged in the manner adopted by Père Provenzali. It will be well to observe that the plan of igniting one flame at a time in order to ascertain the radiant power transmitted by each was resorted to with a view of deciding the question by a similar method to that adopted by the Italian physicists.

The apparatus contrived by Mr. Williams for determining the diathermancy of flame, as described by himself, is exceedingly faulty, the temperature it records being that produced by heat received from several sources. The radiant heat transmitted to the bulb of the thermometer by the flames, acting conjointly with the unknown degree of heat imparted by the surrounding medium, it will be evident that Mr. Williams's device is worthless as an indicator of radiant intensity. His thermometer, agreeably to the published table, indicated 19° C. when exposed to a single flame, and 53° C. when all the flames were ignited; but no information is afforded regarding the temperature of the enclosure (an imperfectly polished vessel) nor was the temperature of the air surrounding the bulb of the thermometer ascertained during the experiment. It is scarcely necessary to explain that in the absence of any indication of the temperature of the air surrounding the bulb of the thermometer, and the temperature of the vessel which radiates towards the bulb, the radiant intensity transmitted by the several flames cannot be determined. Again, Mr. Williams's table, as before stated, shows that the thermometer indicated 19° C. under the effect of the radiation of *one* flame, but this temperature being the joint result of heat radiated towards the bulb by the enclosure, and heat communicated by convection of the air surrounding it, together with the radiant heat transmitted by the flame, the temperature due to the radiation of the latter, viz., the true radiant intensity, cannot be established. Experimenters possessing necessary experience are aware that a thermometer of proper form exposed to radiant heat of moderate intensity requires from twenty to twenty-five minutes before the mercurial column becomes so nearly stationary that the indication may be safely recorded; hence, owing to the close proximity of the flames,

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a considerable augmentation of the temperature of the air surrounding the bulb of the thermometer takes place unless the enclosure, by means of a circulating external cold medium, is maintained at a constant temperature.

Mr. Williams' assumption that the intensity of a gas flame is proportional to the quantity of gas consumed, requires some consideration. Persons practically acquainted with the subject of combustion are well aware of the fact that the intensity of a flame depends on its form and the manner of applying the oxygen, the quantity of combustibles consumed being a subordinate element in the determination of intensity. The annexed table exhibits the result of an experiment just concluded, instituted to determine accurately how far the radiant intensity transmitted by a single gas flame depends on the quantity of gas consumed :—

Consumption of gas per hour.	Temperature of medium surrounding the thermometer.	Temperature indicated by thermometer.	Radiant intensity transmitted by the flame.
Cubic feet.	Deg. Fah.	Deg. Fah.	Deg. Fah.
1·0	60·0	60·63	0·63
1·5	60·0	60·90	0·90
2·0	60·0	61·12	1·12
2·5	60·0	61·30	1·30
3·0	60·0	61·47	1·47
3·5	60·0	61·61	1·61
4·0	60·0	61·74	1·74
4·5	60·0	61·84	1·84
5·0	60·0	61·93	1·93
5·5	60·0	62·01	2·01
6·0	60·0	62·08	2·08
6·5	60·0	62·14	2·14
7·0	60·0	62·19	2·19

It will be seen at a glance, on examining our table, that the radiant intensity transmitted to the thermometer (placed at a considerable distance from the flame, in order to reduce the subtended angle) is not proportional to the quantity of gas consumed. For instance, the differential temperature called forth by the consumption of 7·0 cubic feet of gas per hour is 2°·19, while a consumption of 3·5 cubic feet produces 1°·61, in place of the theoretical temperature $\frac{3{\cdot}5 \times 2{\cdot}19}{7{\cdot}0} = 1^{\circ}{\cdot}09$; thus showing a discrepancy of $1{\cdot}61 - 1{\cdot}09 = 0^{\circ}{\cdot}52$. Again, the consumption of 1·0 cubic feet per hour, instead of developing a temperature of $\frac{1 \times 2{\cdot}19}{7} = 0^{\circ}{\cdot}31$, we find that fully twice that degree of heat is imparted to the thermometer. The reason is obvious ; but it is not intended on this occasion to enter into a discussion of the cause of the stated discrepancy, the object being simply to show the irrelevancy of Mr. Williams' criticism concerning the absence of a record of the quantity of gas consumed.

J. ERICSSON

NOTES

WE are very glad to read the strong and earnest terms in which Mr. Gladstone on Saturday, at the distribution of prizes at the Liverpool College, spoke of the enormous waste of power shown in the administration of our English University endowments, the amount of which is probably equal to that of the whole of the endowments of continental universities taken together, whereas, perhaps, in no other country is there less absolute work to show. England contrasts most unfavourably in this matter with almost every other country in Europe, including her northern and certainly much poorer sister, Scotland. We hope the words of the Prime Minister are an earnest that he will do his best to put an end to this humiliating state of things.

IN the Washington daily *National Republican* newspaper of Dec. 4, a report of Prof. Tyndall's first lecture there is given. The contrast between the first and last paragraphs is very transatlantic.—"Every available inch of room in Lincoln Hall was occupied last evening by an audience distinguished for its appreciation of learning and its enthusiasm in the presence of a great teacher. Conspicuous in the vast assemblage were the faces of citizens eminent for their own advancement in science—citizens who have won imperishable laurels in scaling that mountain on whose jeweled and glittering apex the feet of Prof. Tyndall rest. They were there, the guests of a brother, at an intellectual feast so rich and rare that the profoundest learning, combined with the highest form of genius, was required to prepare and serve it. Prof. Henry, in a short introductory speech, presented Prof. Tyndall to the audience. The lecture throughout was of absorbing interest, and all the experiments and teachings were made so clear and simple that a child could understand them. However, if the old gentleman who was hugging and talking with a young girl all the time, will keep away from the next lecture, those who were annoyed by him will feel thankful." The Washington *Morning Chronicle* of Dec. 6 thus refers to the second lecture—"Another brilliant audience crowded Lincoln Hall to repletion last evening to listen to the distinguished English scientist. Conspicuous in it were President Grant and Miss Nellie, who evinced their interest by undivided attention to the lecturer and his brilliant experiments, Secretary Robeson, Postmaster-General Creswell, and many other of our chief dignitaries. Of course it is useless to protest against the dictates of fashion, but we would like to suggest to the ladies that if they must wear the two-story hats now in vogue, they leave out the tall feather for the benefit of those who have to sit behind them."

THE Council of the Zoological Society have conferred the silver medal of the Society on Mr. A. D. Bartlett, superintendent of the Society's gardens, "in recognition of his valuable services to the Society, and in commemoration of the birth and successful rearing of the young hippopotamus, born on Nov. 5 ;" and the bronze medal on Michael Prescot and Arthur Thompson, the two keepers who had had charge of the hippopotamus during the late eventful period.

THE Chancellor of the Exchequer has declined to accede to a representation from British horticulturists to increase the grant of 6,000*l.* in aid of the British contribution to the Vienna Exhibition of next year.

A SUM of 500*l.* having been placed at the disposal of the Council of the Society of Arts, for promoting, by means of prizes or otherwise, economy in the use of coal for domestic purposes, the Council have decided to offer prizes, including the Society's gold medal and 50*l.*, for each of the following objects :—1. For a new and improved system of grate, suitable to existing chimneys as generally constructed, which shall with the least amount of coal answer best for warming and ventilating a room. 2. For a new and improved system of grate suitable to existing chimneys as generally constructed, which shall with the least amount of coal best answer for cooking food, combined with warming and ventilating the room. 3. For the best new and improved system of apparatus which shall, by means of gas, most efficiently and economically warm and ventilate a room. 4. For the best new and improved system of apparatus which shall by means of gas, be best adapted for cooking, combined with warming and ventilating the room. 5. For any new and im-

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